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Strategic Foresight

PaloVerde™
GENERATING STATION

THE WORLD IS CHANGING

Have you ever wondered how the World Economic Forum plans for complex global issues such as the AIDS epidemic?

Or why BMW is working on a hydrogen vehicle?

Or maybe even why Shell, a traditional oil & gas company, is buying up vehicle charging infrastructure?

A CHANGING WORLD:

↑ COMPLEXITY

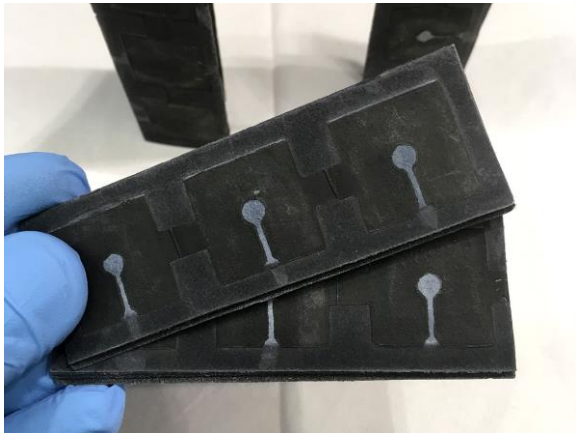
&

↑ UNCERTAINTY

PAPER BATTERIES CHARGED WITH BACTERIA COULD POWER THE INTERNET OF THINGS

- Creation of a cheap, sustainable, single-use battery to power billions of sensors and devices
- Bacteria will both generate an electric current and devour the battery at the end of its useful life

- More than 50 billion electronic devices to be deployed during the next 5 years



Source: IEEE Spectrum

BIG QUESTIONS ABOUT DISRUPTIVE CHANGE

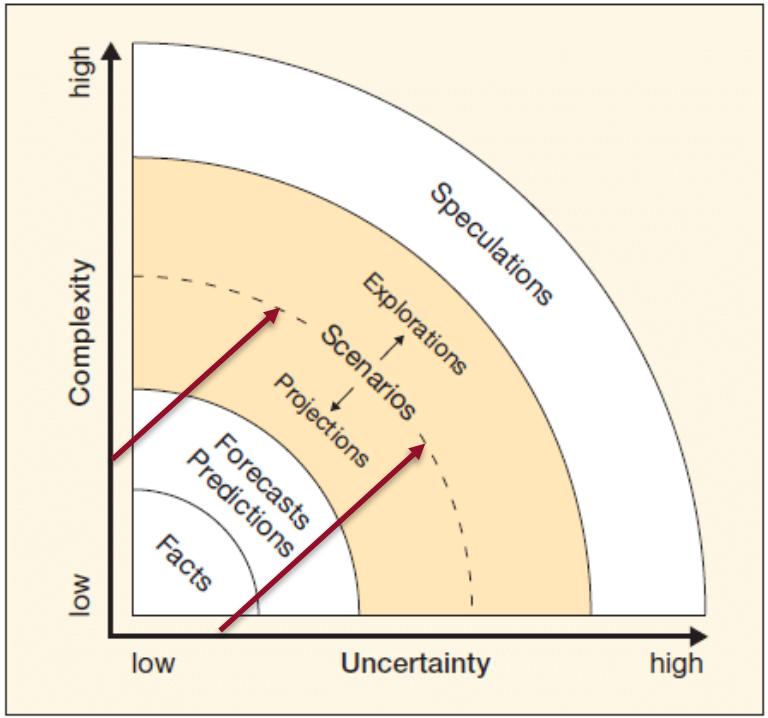
- What new opportunities and new threats are emerging?
- What do these trends mean for us?
- How can nuclear power best prepare for a changing energy landscape?

Source: Selin, 2018

SCENARIO PLANNING PROCESS

CHANGE & SENSEMAKING

- The energy industry is rapidly changing across social, technical, economic, environmental, and political spheres
- Due to the inherent level of uncertainty and complexity, focus must shift from **probability** to **plausibility**
  - Widen lens to the changing world
  - Go beyond straight-line future projections
  - Acknowledge and design for complex disruption ahead



Source: Zurek and Henrichs, 2007

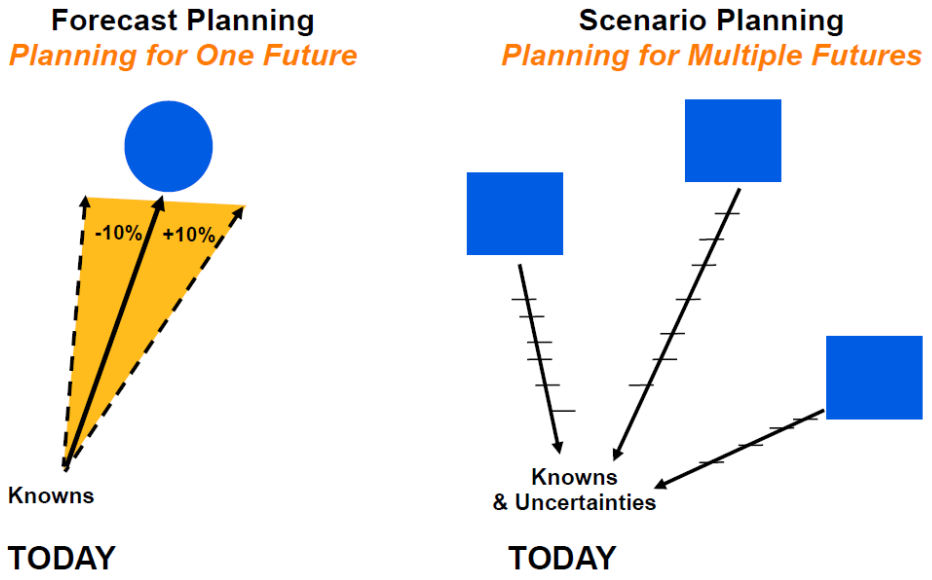
BUILDING A FUTURE-FACING **STRATEGIC OUTLOOK**

FORECAST PLANNING

These often fail in times of great uncertainty and complexity because they assume one future based on what is known today.

SCENARIO PLANNING

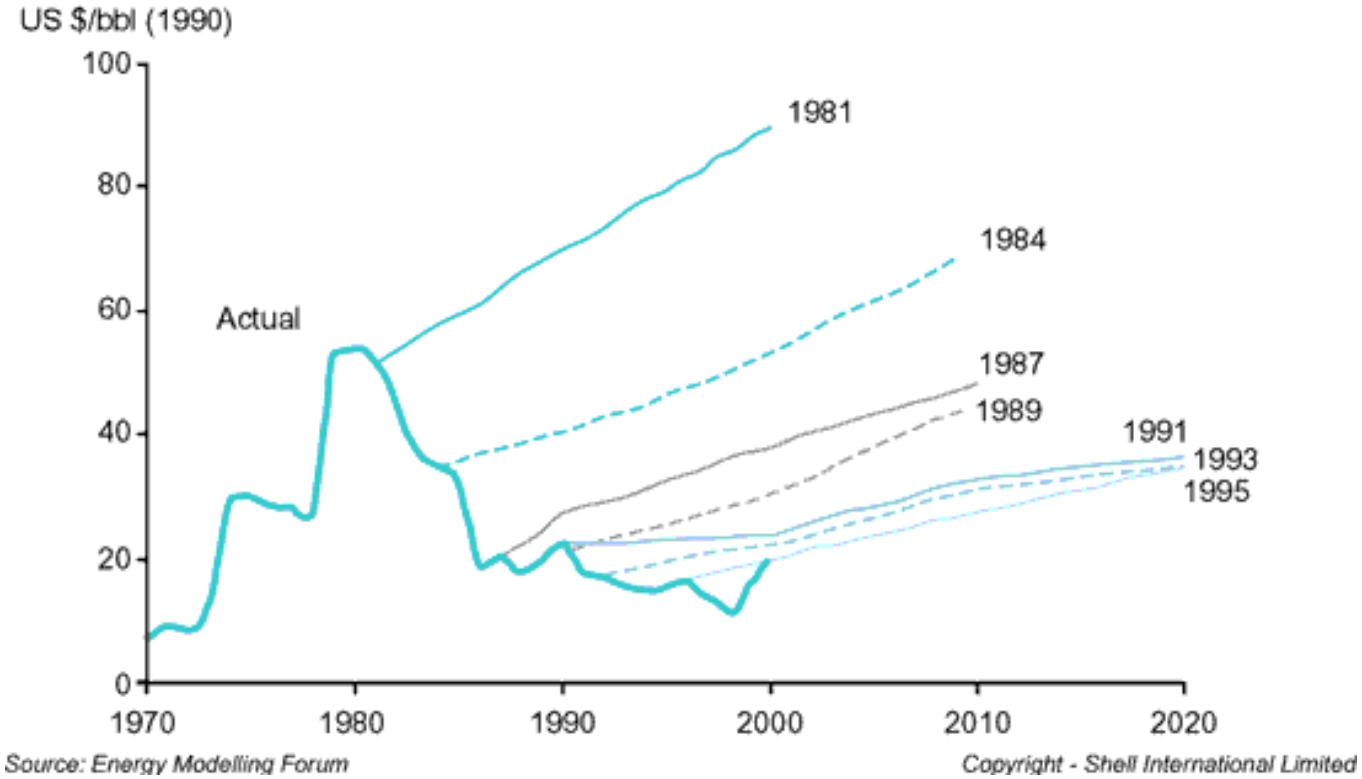
These portray multiple alternative future pathways facing an industry in order to boost preparedness around what is known and unknown today.



Source: Selin, 2006. *Futures*.

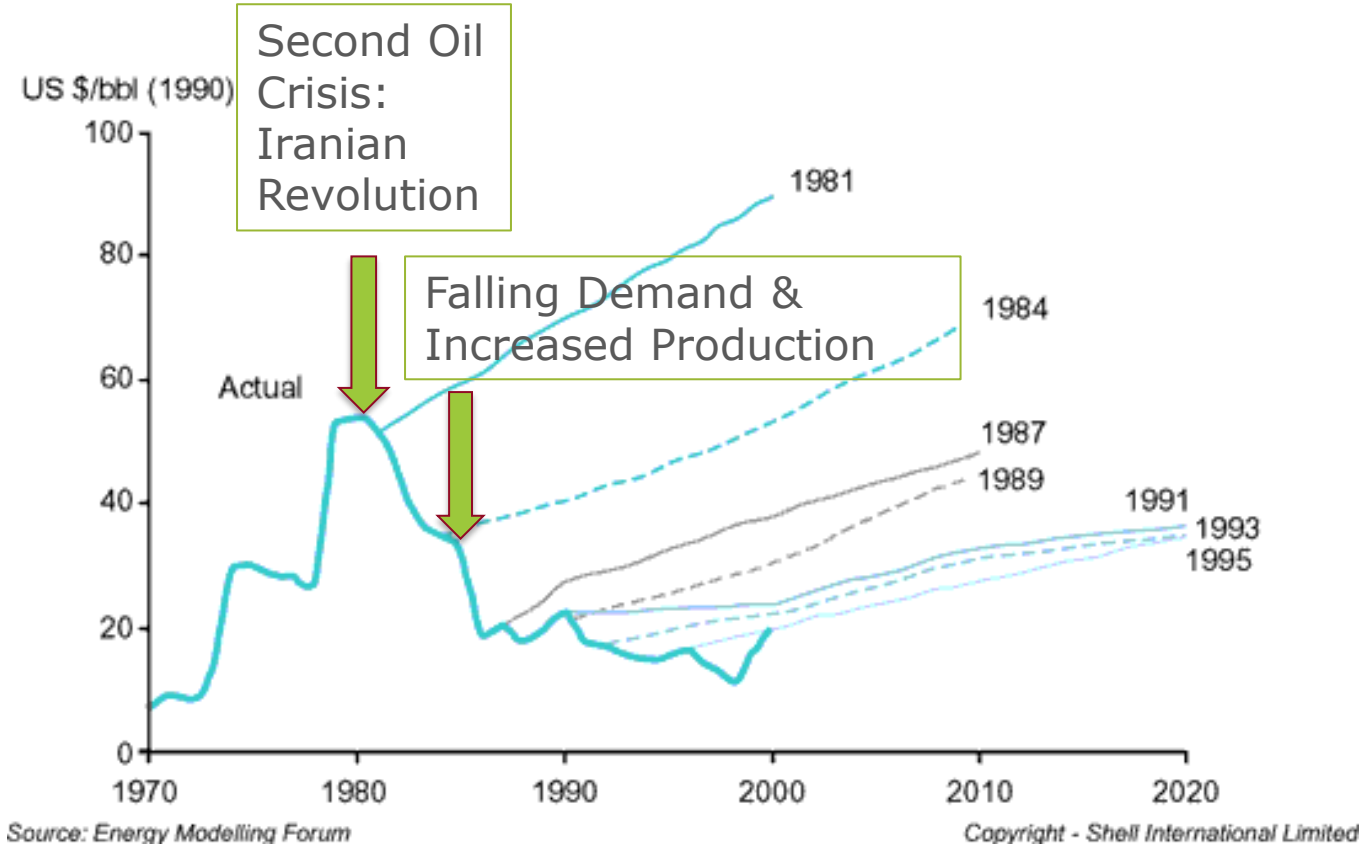
Source: Jay Ogilvy, 2015. Forbes.

THE FUTURE WILL BE DIFFERENT FROM THE PAST



Source: Energy Modelling Forum

THE FUTURE WILL BE DIFFERENT FROM THE PAST



LIMITATIONS OF **FORECASTING**

- Utilities have been surprised:
  - Social trends
  - Environmental trends
- "GE officials have conceded they missed the transition and misjudged the demand for natural gas" (Utility Dive)

BRIEF

GE 'badly' misjudged the clean energy transition, costing investors almost $193B: IEFFA

Source: Utility Dive, 2019

A NEW APPROACH

ENERGY STORAGE TECHNOLOGIES

DIGITIZATION

TRANSFORMATION
OF THE GRID

AUTOMATION, ARTIFICIAL INTELLIGENCE, & MACHINE LEARNING

BROAD SHIFTS

COMMUNICATION
INFORMATION MEDIA

CLIMATE CHANGE

ENERGY POLICY

ELECTRIFICATION

MARKET VALUES

NATURE OF RISK & RETURN

ECONOMIC OUTLOOK

Source: Selin | *Scenaric*

RESEARCH

Broad shifts occurring outside the industry that have the potential to influence utilities/nuclear power.

We used different lenses to study these trends, ultimately driving at two key questions:

- **S**OCIAL
- **T**ECHNOLOGICAL
- **E**NVIRONMENTAL
- **E**CONOMIC
- **P**OLITICAL

What are the main external factors that will shape the future of nuclear power in 2040?

What are the big picture changes that may influence the energy landscape?

Source: Selin | *Scenaric*

ASSESSING IMPLICATIONS TO GENERATE NEW OPTIONS

How will our current way of working fly in the future?

How will our existing strategies perform in each of the scenarios?

What are the pros and cons of each world?

Where are we vulnerable?

What are the new opportunities?

Source: Selin 2017 | *Scenaric*

NEW APPROACH TO INNOVATION

- Shift from reactive to proactive
- Identify new partnerships
- Inspire technical collaboration
- Learn from competitors
- Lead crucial discussions

EXAMPLE

DIRECT **AIR CAPTURE**

Microsoft Taking Action:

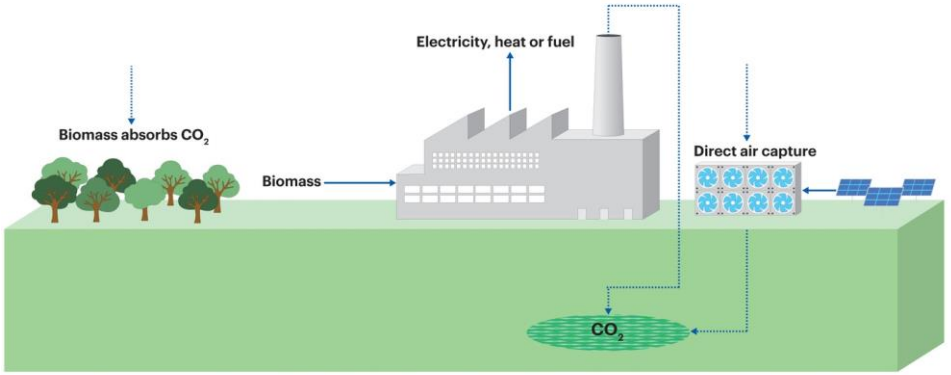
- **2030:** Carbon negative
- **2050:** Remove all carbon the company has emitted *directly* & *indirectly* since 1975
- $1B climate innovation fund (4 years)
  - Carbon reduction
  - Carbon capture
  - Carbon removal

Microsoft President Brad Smith, Chief Financial Officer Amy Hood and CEO Satya Nadella preparing to announce Microsoft's plan to be carbon negative by 2030. (Jan. 15, 2020/Photo by Brian Smale)

DIRECT **AIR CAPTURE**

Technology Solution - Bioenergy with Carbon Capture and Storage (BECCS):

- Heavily relied on in UN IPCC climate modeling
- CO2 captured and injected into deep geological formations
- 2°C target requires plants covering the size of **India**, or larger
  - Conflict with food production
  - High water usage



International Energy Agency (IEA)

Thank you!

Please do not hesitate to connect and contact me:

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Q&A

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